

X.—*On the Life-History of certain Calcutta Species of Satyrinæ, with special Reference to the Seasonal Dimorphism alleged to occur in them.*—By LIONEL DE NICEVILLE, F. E. S.

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(With Plate XII.)

At the meeting of this Society held on the 3rd December, 1884, I read a paper on the Butterflies of Calcutta, and exhibited a series of specimens, chiefly appertaining to the subfamily *Satyrinæ*. In this paper I expressed the opinion that a very marked seasonal dimorphism occurred in this and other groups of butterflies. I also forwarded the same set of specimens to England, and my friend and colleague, Mr. W. L. Distant, exhibited them at the meeting of the Entomological Society of London for February, 1885. My object in bringing the matter thus prominently to the notice of both Societies was to ascertain from the members if they could throw any light on, or offer any opinion as to, the cause of these species being furnished, on the underside of the wings in the brood or broods (most probably the latter) that are on the wing during the rainy season, with strongly marked and conspicuous ocellated spots, while in the same species, or other species that take their place, during the cold and dry seasons these markings are obsolete or entirely wanting, and the general tone of colouration is much paler and more leaf-like. This expression of opinion may have been somewhat premature so far as the question of the seasonal dimorphism went, which certainly had not at that date been proved; but certainly not so far as the occurrence of ocellated species in the rains and of non-ocellated ones in the cold and hot seasons is concerned, facts of which I had convinced myself by long previous observation. It may be repeated that the Calcutta year is roughly divisible into a cold season (extending from the middle of October to end of March), a hot season (from April to middle of June), and a wet season or rains (from the middle of June to the middle of October).

A short discussion followed Mr. Distant's remarks on the specimens exhibited at the Entomological Society of London, but I was sorry to find that no solution of the phenomenon was suggested by the members present. My suggestion was that the obliteration of the ocelli was an advantage to the insects during the cold and hot seasons, as at those times the vegetation is much more scanty and dried up, the insects live chiefly among the grass, and would consequently be easily seen were they not inconspicuously coloured and marked; while in the rains, the

vegetation being then very dense, they can hide themselves, and their conspicuous livery is no bar to their safety. My belief that these ocellated spots are conspicuous and non-protective rather than the reverse, is, I am aware, contrary to the opinion of many eminent naturalists; I can, however, only state my opinion to the contrary for what it is worth and as the result of my own observations: I can see, for instance, a *Mycalesis mineus* with its big eyes and prominent white discal line far sooner and more easily than I can the plain evenly coloured and marked *M. indistans*, but whether this is so with the birds, lizards, Mantodea, predaceous flies, &c., which live largely on butterflies, I am unable to say. Having brought the subject to notice, I hope that it will attract the attention of observing naturalists, and that a solution of the question may soon be forthcoming.

As to the second point, whether the fourteen named species of butterflies referred to represent that number of distinct species or half that number, I have been able to prove by breeding direct from the egg that the extraordinary seasonal dimorphism which I had suspected to occur does actually exist in the case of four of them; the three remaining species must wait till the commencement of next rains, when I hope to complete the experiment.

The transformations of the genus *Melanitis* have long been known. As far back as 1829 Dr. Horsfield* figured the larva and pupa from Java of *M. leda* (= *M. determinata*, Butler); Mr. Moore† in 1831 figured those of *M. tambra* from Ceylon, and Surgeon-Major Forsayeth‡ those of *M. ismene*. But the transformations of the large genera *Mycalesis* (containing 86 species, according to Mr. Moore's Monograph in 1880, and many new species since described) and *Ypthima* (containing 31 species up to 1877, according to Mr. Kirby's invaluable Catalogue) have hitherto been quite unknown. And yet, so far as my experience goes, it is very easy to breed them: it is only necessary to procure live females, and to shut them up in any kind of box, in which they will lay eggs; if the box has a gauze cover, the eggs will be found attached to it; if blades of grass, or, better still, a pot of growing grass, is placed in the box, the eggs will be laid on the grass. I have had no difficulty in getting species of *Satyrinæ* to oviposit, though I have often failed with butterflies of other families. I will now proceed to give in detail the results of my experiments.

* Cat. Lep. Mus. E. I. C. pl. viii, fig. 9, larva; 9a, pupa (1829).

† Lep. Cey. vol. i, pl. ix, figs. 2c, larva and pupa (1880).

‡ Trans. Ent. Soc. Lond. 1884, pl. xiv, figs. 2, larva, just before turning to a pupa; 2b, pupa.

1. YPTHIMA HUEBNERI, Kirby. Pl. XII, Fig. 1.

Y. hübneri, Kirby, Syn. Cat. Diurn. Lep., p. 95, no. 18 (1871); idem, id., Distant, Rhop. Malay., p. 57, no. 4, pl. vii, fig. 5, ♀ (1882); *Y. huebneri*, Marshall and de Nicéville, Butt. of India, vol. i, p. 226, no. 217, pl. xvii, fig. 65, ♂ (1883); *Y. philomela*, Hübner (*nec* Linnæus), Zutr. Ex. Schmett., figs. 83, 84 (1818); id., Hewitson, Trans. Ent. Soc. Lond., third series, vol. ii, p. 284, no. 4 (1865); *Y. howra*, Moore, Journ. Asiat. Soc. Bengal, vol. liii, pt. 2, p. 17 (1884).

On September 5th, 1885, Captain C. A. R. Sage* of the 18th Bengal Infantry sent me in a tin box with a gauze cover seven live females which had that day been caught. At the hour I received them (5-30 P. M.) they had laid over 70 eggs of a beautiful light green colour on the gauze cover, and two on the side of the box. On Sept. 9th, larvæ commenced to emerge, and I placed the gauze on which the eggs were laid amongst some grass growing in a pot, covering the whole with a large wooden box with glass sides. The larvæ rapidly fed up, and turned to pupæ, the imagines emerging between October 19th and 25th, as true *Y. huebneri* like their mothers. The pupæ were sometimes green, sometimes brown.

On my return on November 8th from my annual autumn holiday in the Sikkim hills, Captain Sage gave me six about half-grown larvæ which he had hatched on October the 20th from eggs laid by *Y. huebneri* on the 15th. Being few in number these larvæ were fed up by me in a stoppered glass jar, fresh grass being supplied about every other day. The first of them changed to a pupa on November 20th, and the imago emerged on December 7th; on November 22nd, another larva changed to a pupa, the imago emerging December 9th; on November 25th, two more larvæ changed to pupæ, the imagines emerging Dec. 12th; on December 3rd, another larva changed to a pupa, the imago emerging December 19th; on December 12th, the last larva changed to a pupa, the imago emerging on January 1st. All the pupæ were green, and all the imagines were true *Y. howra*. The colour of the pupa does not, I believe, affect the imago in the least; it is purely protective, the green ones in nature being probably attached to the green blades of grass, while the brown ones occur on the dark-coloured stems near the roots. The larva when full grown is about an inch or a little less in length, entirely green, the head round, body of nearly equal thickness throughout, slightly increasing in size to the fifth segment, thence gradu-

* I am much indebted to this gentleman, who was at that time living on the outskirts of Calcutta (Alipur), for live specimens of the different butterflies with which I have experimented. He also bred the same four species from different batches of eggs, several of them more than once, and always arrived at the same results as I did, as I can testify from having perused his notes and inspected his specimens.

ally tapering to the anal segment, which is furnished with two very short diverging immovable processes or tails. The head and body are thickly shagreened, that is, covered with very small closely-set tubercles emitting fine colourless hairs. There is a dorsal line somewhat darker green than the rest of the body, which becomes white at the fourth segment, and extends right through the crown of the head. There is also a paler green lateral line below the spiracles. The pupa is either green or brown, with the head rounded, the edge of the wing-cases raised and angled anteriorly, the thorax humped, and marked, like the abdominal segments, with some dark brown waved lines and spots.

With regard to this species Mr. Butler remarks* that I have "yet to explain to which form, the dry or the wet, the intermediate grades" [between *Y. huebneri* and *Y. howra*] "belong." The intergrade forms referred to, in which "the ocelli are reduced to points," probably occur either at the beginning of the wet or of the dry seasons, though in the case of this genus I have noticed that the seasonal forms are less well-marked than in either *Melanitis* or *Mycalesis*: now and again a perfectly ocellated specimen may be found in the middle of the dry or cold season, or a non-ocellated one in the rains, but this does not much militate against the fact that in the rains the prevailing form will be ocellated, in the other seasons non-ocellated. The many variations that occur in this species are very fully treated on in "The Butterflies of India, Burmah and Ceylon." I was a little surprised to see that Mr. Moore, in the face of what is recorded in that work on this subject, and without any reference thereto, had described one form of it under the name of *Y. howra*.

Captain Sage first took *Y. howra* on November 18th, at a time when a few *Y. huebneri* were still on the wing, this being the earliest date on which he captured the cold and dry season non-ocellated form of this species.

2. YPTHEMA PHILOMELA, Johanssen. Pl. XII, Fig. 2.

I am unable to give the synonymy of this species, whose correct identification and geographical range are matters about which there is much uncertainty and difference of opinion. I consider that the species should be known as *P. philomela* (as pointed out by Mr. Kirby in his Catalogue), Johanssen having described it first from Javan specimens, of which there are a pair in the Indian Museum, Calcutta, collected by Dr. Horsfield in that island; these specimens are, so far as I can see, conspecific with the Indian ones. The *Papilio lisandra* of Cramer described from China may or may not be distinct, for I possess no specimens from that country for comparison. Mr. Moore considers the Indian species to

* Proc. Ent. Soc. Lond., 1885, p. v.

be the *Papilio baldus* of Fabricius, who described it from India; in this he is followed by many authors, including Hewitson in his Monograph of the genus, who gives Java and Sumatra as well as India as its habitat. Mr. Elwes records it from China, Japan, and Amurland. Mr. Distant (who followed Mr. Butler) identified it as the *Y. methora* of Hewitson, and has sent me several specimens from the Malay Peninsula which I am unable to separate specifically from *Y. philomela*. Mr. Butler identifies* my Calcutta specimens as "*Y. methora*, Hewitson, variety." I have lately, since Vol. I of "The Butterflies of India" appeared, had the good fortune to obtain, from Mr. Otto Möller from Darjiling, and from Mr. A. V. Knyvett from Buxa, Bhutan, a considerable series of both the ocellated and non-ocellated forms of the true *Y. methora*, the former occurring in the spring (March and April), the latter in the summer (August). Hewitson's types were all three females, the locality from which he described the species being North India and, as given in Mr. Kirby's Catalogue of his collection, Sikkim and Yunan. The specimens Major Marshall and I identified in "The Butterflies of India" as *Y. methora* from Yunan do not appear to be that species (Hewitson seems to have made the same mistake, as he placed specimens from both Sikkim and Yunan under that name), having a sexual streak in the male, which the true *Y. methora* does not possess. I cannot therefore agree with Mr. Butler in considering the Calcutta species as a variety of *Y. methora*, of which Mr. Hewitson described and figured a female of the strongly-ocellated summer brood. *Y. laroides*, Westwood, is stated to occur at the Cape of Good Hope, but Mr. Trimen does not mention it in his South African Butterflies; and it also may be a synonym of *Y. philomela*. *Y. lara*, Donovan, is recorded from the Cape, but it is also unknown to me. Lastly, Mr. Butler described a species of *Ypthima* from Upper Tenasserim under the name of *marshallii*. Mr. Moore has kindly thus named for the Indian Museum, Calcutta, numerous specimens of the non-ocellated form of *Y. philomela*, and on this authority, in addition to the fact that these Calcutta specimens agree fully with Mr. Butler's description of *Y. marshallii*, I expressed my opinion that this species is nothing else than the non-ocellated form of *Y. philomela*. Mr. Butler (without having seen my specimens) denied the fact, but on seeing them subsequently, when Mr. Distant took them to the

* I have to express my indebtedness to Mr. W. L. Distant for having, after some difficulties and delays which have retarded the publication of this paper many months, obtained Mr. Butler's identifications of the specimens exhibited at this Society and also at the Entomological Society of London. When Mr. Butler wrote his remarks on my suggestions on the seasonal dimorphism obtaining in these species, he had not even seen the specimens in question!

British Museum for his inspection, he admitted that they are that species. This name, therefore, falls.—Leaving the confused and disputed question of the synonymy of this species, I will proceed to give the results of my experiments in breeding it.

On September 10th, Captain Sage sent me a tin box with net cover containing several females of *Y. philomela*. The insects had laid numerous eggs on the net, which differ considerably in colour from those of *Y. huebneri*, being at once distinguishable by the naked eye. On September 14th, two larvæ emerged. On September 18th, eighteen more emerged, and I placed all the young caterpillars in a stoppered glass jar on the same grass as that which was used for *Y. huebneri*. The larvæ are at first exceedingly small, pinkish-white in colour, hairy, and with a pinkish head. When full-grown, they are a full inch in length, rather larger therefore than *Y. huebneri*, with the body more compressed than in that species and flattened to a ridge line below the spiracles, the head rounded, the second segment a little larger than the head, the third and fourth segments gradually increasing to the fifth, then very gradually decreasing to the anal segment, which is furnished with two very small immovable pointed processes or tails. The larva is reddish-ochreous coloured throughout, not green as in *Y. huebneri*, with an indistinct darker dorsal line, two narrow subdorsal ones, and several other very narrow lines placed very close together in the spiracular region above the lateral ridge. There is also a subdorsal series of about eight short oblique streaks. The head and body throughout are shagreened, being covered with small tubercles bearing very fine short hairs. The pupa is either pale ochreous with darker ochreous and brown markings, or pale green with dark brown markings. It is very narrow, the thorax longitudinally humped above, with another ridge just before the abdominal segments placed transversely. On Oct. 8th, one larva; on Oct. 9th, seven larvæ; on Oct. 10th, two larvæ; and on Oct. 11th, one larva changed to a pupa. On Oct. 17th, three females emerged; on Oct. 19th, two males and one female; on Oct. 23rd, two females, and on Oct. 24th, one female emerged; and two larvæ died. All these butterflies proved to be true *Y. philomela* like their female parent.

On my return from Darjiling on November 8th, Captain Sage gave me eight very small larvæ which had emerged on November 4th from eggs laid by a female *Y. philomela* on October 29th. On December 16th, one larva changed to a pupa, which disclosed a male imago on January 5th; on December 18th, a larva changed, a female imago emerging on January 10th; on December 24th, a larva changed to a pupa, a female emerging on January 16th; and on December 28th, two larvæ changed to pupæ, a female emerging on January 19th from the one, and a male

on January 20th from the other. Two larvæ died, having shrivelled up in the act of turning, possibly in consequence of the atmosphere of the glass jar in which I bred them not being sufficiently moist, for in nature these animals must get heavily drenched with dew every night. All these butterflies bred from eggs laid by *Y. philomela* proved to be true *Y. marshallii*. I may add that Captain Sage, who kept a careful register of his captures from day to day, first observed "wild" specimens of *Y. marshallii* on November 18th, having for months before caught *Y. philomela* only.

3. MYCALESIS MINEUS, Linnæus. Pl. XII, Fig. 3.

The synonymy of this species when it comes to be fully set down (and unfortunately I do not possess the necessary material from extra-Indian sources to attempt the task) will be stupendous. In India this species is certainly represented by *mineus*, Linnæus; *drusia*, Cramer; *polydecta*, Cramer; *justina*, Cramer; *visala*, Moore; and *indistans*, Moore; the first four species representing ocellated forms, the last two non-ocellated forms.

Males of typical *M. mineus* can at once be distinguished by an ochreous or pale golden elongated patch on the underside of the forewing near the base of the inner margin of closely-packed scales placed on either side of the submedian nervure near its middle, which patch is widely surrounded by an area of shining very closely-packed darker scales; a somewhat similar patch is also present on the upperside of the hindwing near the base of the first subcostal nervule. This patch is also found in typical *M. indistans* (and it is needless to state that it occurs also in *M. visala*, which is but a slight local variety of the latter form). In typical *M. blasius* and in its probably non-ocellated form *M. perseus*, these patches are very much smaller and black. Where these patches are well-marked and the characteristic markings occur with them, these two species, *mineus* and *blasius*, can be at once distinguished. But the identification of large series of specimens of this group of *Mycalesis* from various parts of India is complicated by this structural character appearing to be by no means constant, and moreover by the large yellow patch being sometimes associated with the markings of *M. blasius* and *M. perseus*, and the small black patch with those of *M. mineus*; so that when an attempt is made to sort them into separate species by one character, an unnatural result is obtained. I wish here only to draw attention to these circumstances. My own belief is that hybridisation takes place extensively. In Calcutta I have not as yet met with any of these puzzling specimens, but such seem to occur commonly in other parts of India. Local breeding experiments should be carried out to decide the question.

I will now give the results of my breeding of this species. On September 1st I placed two female *M. mineus* in a breeding-cage with glass top and sides into which I had previously introduced a pot of growing grass. The same evening the insects laid about thirty eggs singly and in batches on both sides of the blades of grass indiscriminately. The eggs are almost white, shining, and semitransparent. On September 5th, the one female died, and her body on being opened was found to be quite empty and devoid of eggs. On September 6th, the other female died, and most of the eggs hatched. As usual the young larvæ made their first meal off the empty egg-shells. They are pale green with a black head bearing two very obtuse black horns on the crown, and with the caudal processes very small.

Down to the last change of skin, the larvæ are pale green without any conspicuous markings; after that change they become pale reddish, finely mottled with greenish, ochreous, and other colours, the general effect being somewhat that of the brownish colour of a grass stalk to which the bases of the dead leaves are still attached. At this stage, the larvæ remain chiefly amongst the bases of the grass stalks, where they are very difficult to be seen. When full-grown, they are about $1\frac{1}{4}$ inches long. The first segment is somewhat narrower than the head, the body gradually thickens to the middle, and then equally regularly and gradually tapers to the anal segment, which is furnished with two short, slightly divergent pointed processes or tails. There is a very faint greenish dorsal line, with about six obscure darkish oblique streaks at the sides, the four middle ones of which are the most prominent. The head is blackish, armed with two divergent, blunt, conical horns, which are obscure reddish like the body; both head and horns are thickly set with small rough tubercles, and the face is covered with short hairs. The whole of the body is very rough or rugose, and very thickly set with minute tubercles. The legs and underside of the body are coloured like the upper surface. The pupa is usually pale semitransparent green without markings, quite smooth, with the thorax very convex above and constricted at the base of the abdomen, and with the spiracles black. I obtained one differently coloured pupa: this was rich reddish-brown, with the spiracles prominently bright yellow. The larvæ turned to pupæ between September 28th and October 4th, and butterflies emerged between October 5th and October 12th,—it seems, unnecessary to record the exact dates. The imagines, though variable, were all nearer to *M. indistans* than to *M. mineus*, while the majority were true *M. indistans*.

Mr. Butler* appears to consider the non-ocellated form of *M. mineus* (*M. indistans*) as rare. In Calcutta it is far commoner than the

* Proc. Ent. Soc. Lond. 1885, p. vi.

ocellated form, the former occurring for about two-thirds of the year, but the latter for the remaining third only.

4. MELANITIS LEDA, Linnæus. Pl. XII, Fig. 4.

The synonymy of this species also will be vast when written in full, as not only must all the numerous forms of *M. ismene*, Cramer, be added to it, but also the numerous intergrade forms that have been described, including that latest bantling of Mr. Butler's, *M. determinata*,* which, even if the "lurid" *M. leda* should prove constant, must sink under the far older name *M. ismene*. Its range is enormous: it occurs in Eastern, Western, and Southern Africa both as true *leda* (as universally accepted) and as *banksia*, throughout Southern Asia, in the Pacific Islands, and in Australia. Whether it presents dimorphic forms throughout its range, I cannot say. The specific extent of the genus *Melanitis* must long remain in doubt, until, in fact, breeding experiments have been carried out extensively; but I believe that there are several good species in India alone, though how many I am not prepared to say: in Ceylon, for instance, *M. tambra* is probably distinct from *M. leda*, in Sikkim *M. zitenius* and *M. tristis* may be good species, and so on.

I did not keep a very exact record of dates in breeding this species, as the transformations, as stated above, had been previously recorded, but, from eggs laid by *M. leda* (= *determinata*, Butler) in August, I bred, on September 6th, a female *M. leda*, on the 7th, another female; on the 8th, two female *M. ismene*, one with distinct ocelli, and therefore an intergrade between *M. leda* and *M. ismene*, though nearer the latter; on September 9th, one male and two females of *M. ismene*; on September 10th, three males and four females of *M. ismene*, several of which are intergrades, and one male *M. leda*; on September 11th, two males and one female (the latter a highly ocellated specimen) of *M. ismene*; and on September 12th, one male of *M. ismene*: the total result being that from nineteen pupæ bred from eggs laid by true *M. leda*, I obtained three specimens (1 ♂, 2 ♀) like the mother, and sixteen specimens (7 ♂♂, 9 ♀♀) of *M. ismene*, several of which, though transitional forms, were yet all nearer to *M. ismene* than to *M. leda*.

My efforts to breed a second generation failed, all the specimens dying without coupling or laying eggs.

Captain Sage first observed a specimen of *M. ismene* on September 23rd, the only *Melanitis* seen by him for several months previously being *leda*.

To conclude, I would earnestly ask entomologists living in the tropics to devote as much time and attention as they can to breeding but-

* Ent. Month. Mag. vol. xxi, p. 246 (1885).

terflies from the eggs at different seasons, but especially, if the seasons are strongly marked, at the commencement or at the end of each change. My experiments have as yet been applied to four species only, and I think I may safely say that the results to most entomologists are most unexpected. I could indicate many dozens of Indian species in which I believe this seasonal dimorphism to occur, embracing nearly every family into which butterflies have been divided, but I might be again accused of "guessing." The subject is a most interesting one, and I hope to revert to it again before long.

EXPLANATION OF PLATE XII.

Fig. 1, Larva from above; 1 a, green pupa; 1 b, brown pupa; bred from eggs laid in captivity by true *Ypthima huebneri*.

Fig. 2, Larva from above; 2 a, pupa; bred from eggs laid in captivity by true *Ypthima philomela*.

Fig. 3, Larva from above; 3 a, green pupa; bred from eggs laid in captivity by true *Mycalesis mineus*.

Fig. 4, Larva from above; 4 a, front view of head of full-grown larva; 4 b, pupa; bred from eggs laid in captivity by true *Melanitis leda*.

